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Guide to the Lichens of the New York Area—Part 3

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PAPERY LICHENS (Groups 5 to 12)

Among the Papery Lichens, differences in form are somewhat less obvious than among the Stalked Lichens. The aim of this guide is to make possible the identification of a great many species with no other aid than a hand-lens, but in order to give a clearer idea of relationships, and to make determinations more certain, microscopic characters are mentioned also and given increasing prominence as the forms become simpler, the obvious distinctive characters fewer.

Papery Lichens are flattened to make an upper surface, and an under surface different from it in structure and usually in appearance. This under surface is sufficiently free from the foothold so that it can be inspected and described. Stalked Lichens (Groups 1 to 4) differ from papery Lichens in having some sort of stalk, or in being lifted largely well clear of the foothold. After an intermediate class of Flake Lichens (Group 13), the Crust Lichens (Groups 14 etc.) differ from Papery Lichens in having no free under surface, but adhering tightly to the foothold or even growing within it.

KEY TO THE PAPERY LICHEN GROUPS

(This key will not be found entirely satisfactory, especially if no compound microscope is available, and chief reliance should be placed rather on a careful reading of the general description of each group, on the illustrations, and on the references to similar species at the end of each specific description.)

Algal cells not in chains

- Lichens bright yellow or orange, with yellow or orange fruits Group . 9
- Lichens greenish gray, whitish, pale yellow, brown or olive
- Fruits chestnut-brown or greenish (yellowish gray in *Cetraria placorodia* and *Parmelia ambigua*).
- Spores undivided, colorless

- Small lichens with parts usually narrower than 5 mm. Group 5
- Larger lichens, parts mostly broader than 5 mm. Group 6
- Fruits gray, whitish or blackish. Spores 2-celled, blackish or brownish Group 8
- Fruits black, with minute brain-like convolutions. Lichen an unbranched leaf Group 12
- Fruits hidden within the tissues, showing as dark dots on the upper surface Group 12
- (See also *Peltigera aphthosa* and *Sticta* in Group 7)
- Algal cells in chains
- Lichens greenish gray, rosy gray or brown, not gelatinous
- Fruits chestnut-brown on special lobes projecting from the tips Group 7
- Fruits scattered on the upper surface, light red or reddish brown
- Lichen parts usually broader than 5 mm. Spores divided into 2 or more cells Group 7
- Lichen parts narrower than 5 mm. Spores not divided Group 10
- Lichens dark green, dark brown, olive, or lead gray, gelatinous-looking when wet Group 11

Group 5. The Smaller Shield Lichens. Mats of paper-like structure growing close to the bark, stone, or other foothold, or the tips and margins rising somewhat from it. Divided into radiating trunks, more or less branching, and lobed. Trunks and lobes usually narrower than 5 mm. Fruits typically chestnut-brown, sometimes pale brown, greenish or gray, especially when wet. Spores undivided, colorless.

Cetraria fahlunensis. SWEDISH SHIELD LICHEN.

In the mountains of northern New England, and rarely as far south as the New Jersey highlands, on exposed, rocky summits, this tiny Shield Lichen grows flattened against the usually vertical face of rock containing quartz, in tufts commonly 3 or 4 cm. across. The radiating trunks branch profusely, and grow over each other to form an interwoven mat sometimes 2 mm. or more deep. Trunks and branches maintain a rather uniform

width of about 1 mm., with the tips a little wider or narrower. Margins and tips are lifted a little, forming a shallow trough. In some specimens, tiny, blackish granules border the older parts. In the form seen in the Shawangunk and Kittatinny Mountains, sometimes called var. *Frostii*, the margins are dusted with whitish soredia. The upper surface is smooth, shining brown or dark olive at the tips, blackish on the older parts or all bleached rather grayish. Under surface slightly paler, with a few dark, root-like holdfasts.

Fruits, seldom or never seen in the New York area, are unexpectedly large, up to 1 cm. in diameter, and seated rather tightly against the older trunks. Color dark brown. Rim smooth or beaded. Spores undivided, colorless, 5 to 11 by 3 to 7 microns.

Cetraria fahlunensis looks at first glance almost exactly like *Parmelia stygia*, a northern lichen which hardly reaches the New York area, and which has the trunks and branches slightly convex instead of trough-shaped, the under surface being pitch-black instead of brown. *C. saepincola* (Group 4), though of nearly the same color, rises much higher from the foothold, grows on trees and wood instead of rocks, and has plentiful, much smaller fruits. Shining tips distinguish all these Shield Lichens from the dull-surfaced *Physcia aquila* (Group 8) and *Pannaria microphylla* (Group 10), both of which are brownish in color. Perhaps *Parmelia omphalodes*, a strictly northern, small, brown variety of *P. saxatilis*, should also be mentioned here. It has wider and thinner parts than *C. fahlunensis*, the upper surface somewhat pitted, and the under densely clothed with root-like holdfasts. It is rarely or never found in the New York area, nor is *P. sorediata*, a form of *P. stygia* with round, white soredia.

Cetraria pinastri. PINE LICHEN.

Also called *Cetraria juniperina* var. *pinastri*. A form similar to *C. juniperina* (Group 4) in color, yellowish to olive green on the upper surface, yellow on the under, with the margins usually breaking into greenish yellow dust (soredia). Some consider these soredia the determining character of *C. pinastri*, but neither this view nor any other can explain satisfactorily the intermediate forms. This lichen is typically small and straggling,

with lobes but little divided, and less than 5 mm. wide. The margins usually rise above the foothold to a height of less than 5 mm. It is seen commonly on rocks in the highlands of New England, New York and New Jersey, but also grows on trees. It does not fruit, though intermediate forms may. The important characters are the yellow under surface and yellow soredia.

Except for the close relationship with *C. juniperina* from which perhaps it need be separated only in order to make recognition easier, *Cetraria pinastri* is not likely to be confused with other lichens. *C. Oakesiana*, resembling it somewhat, has pale green, not yellow soredia, and a brown under surface. *C. aurescens* is white beneath, and without soredia. *Parmelia ambigua*, *P. centrifuga*, *P. incurva*, and the larger *P. conspersa* and *P. caperata* (Group 6), with *Candelaria concolor* and other species of Group 9, though all yellow or yellowish on the upper surface, are never yellow on the under.

Cetraria Oakesiana. OAKES SHIELD LICHEN.

Throughout the highlands and pine barrens, this species will be met in many localities, but not too plentifully, on trees and rocks. Once learned, it is easy to recognize, yet at first each point of the description must be checked carefully. Its trough-like branches, usually about 5 mm. wide, spread irregularly side by side, not forming symmetrical rosettes, but rarely overlapping. They usually rest on the foothold, but their margins curl away from it 2 or 3 mm., and are waved and crinkled, though not much lobed, often foaming into a *pale green* dust of soredia, fading later to whitish. The upper surface is smooth, or only slightly wrinkled, pale grayish green, the under surface light brown, with a few brownish holdfasts sometimes visible.

Except in the high mountains, and then rarely, it does not fruit. Fruits dark brown, up to 6 mm. across. Spores undivided, colorless, 5 to 10 by 4 to 6 microns.

The pale green soredia distinguish it from other Papery Lichens, but when these have faded or are wanting, the general habit, curling margins, and light brown under surface must be noted. It will be found in association with *Cetraria ciliaris* and *C. lacunosa* (Group 4), which rise high above the foothold, and with many species of *Parmelia*, none of which are trough-shaped. *Physcia speciosa* and *P. sorediata* (Group 8) often have colored soredia, but pale blue, not green.

Cetraria aurescens. YELLOWING SHIELD LICHEN.

A small, rather rare lichen described from New England and New Jersey, growing on coniferous trees and old rails, and to be looked for in the pine barrens. It looks something like a pale, flat form of *C. juniperina*, with a wrinkled and warty upper surface pale yellowish green or yellowish gray, the under surface whitish, with many whitish root-like holdfasts. Only the crinkled margins and tips rise from the foothold. Its many branches and lobes 2 or 3 mm. wide, rarely spread more than 4 or 5 cm. in an irregular pattern.

Fruits are frequent, large in proportion, up to 7 mm. across, and often mounted above the margins on spurs as much as 5 mm. high. The disk is chestnut-brown, the rim toothed. Spores undivided, colorless, 3 to 6 by 3 to 5 microns.

From *C. juniperina*, *C. pinastri* and *C. Oakesiana*, *Cetraria aurescens* can be distinguished by the white under surface and the absence of dusty soredia, from *C. placorodia* and *Parmelia ambigua* by the crinkled and lifted margins. The spores also are smaller than those of any local Shield Lichen except the very different *Parmelia colpodes* with swollen tips.

Cetraria Fendleri. FENDLER SHIELD LICHEN.

A rare lichen to be looked for on pine bark in the pine barrens, where it often spreads only 1 or 2 cm., or is reduced to a few mere wisps around crowded fruits. The typical color is brownish olive, dull, not shining, with a white under surface. The tips and margins are usually slightly raised and finely cut, with small lobes ending in many delicate points which might sometimes be considered marginal hairs.

Fruits are many and often crowded, chestnut-brown, shining, smaller than 4 mm. in diameter, and with rims distinctly toothed or notched, or even minutely lobed. Spores undivided, colorless, 4 to 11 by 4 to 5 microns.

Owing to its small size and dark coloring, *Cetraria Fendleri* will easily escape observation. At a glance it looks somewhat like the common *Physcia endochrysea* (Group 8) which is small and olive-gray, but which, when scratched with the fingernail, reveals an internal blood-orange color. The finely divided and pointed lobes of *C. Fendleri* distinguish it from all other brown Papery Lichens. With it on the pine bark will be found the flakes of *Psora anthracophila* and *P. ostreata* (Group 13) and

various species of *Cladonia* (Group 1), some of which take a brown color. As these are very common, a little observation will separate them from *C. Fendleri*, which is rare, and of quite different structure.

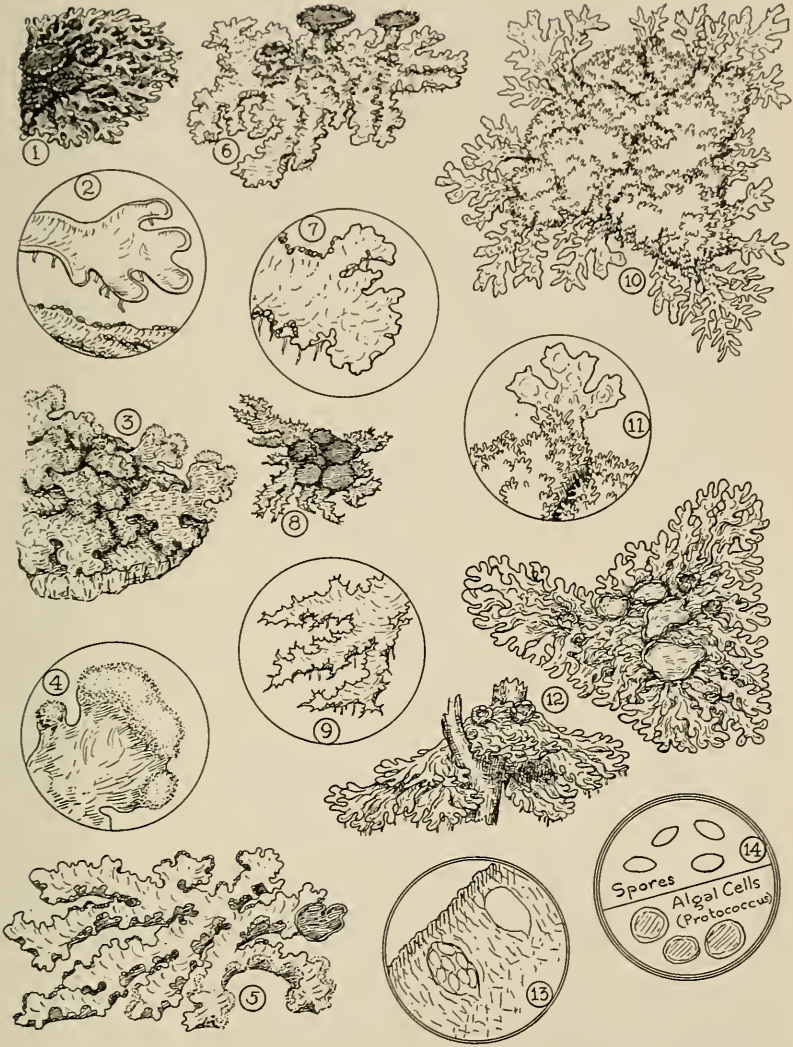
Cetraria aleurites. GRIZZLY SHIELD LICHEN.

Also called *Parmeliopsis aleurites*. A common species found especially on pine bark, rails and dead wood, in swamps, pine barrens and hills everywhere. It forms a grayish white rosette flat against the foothold, with branches and lobes radiating to a total spread of 5 cm. or more, but is often fragmentary. Branches may be 2 or 3 mm. wide, but the usually short tips, less than 1 mm. wide, are sometimes divided into feathery lobes less than 0.1 mm. wide. Scattered over the dry-looking upper surface are minute white or yellow-gray granules, becoming very numerous toward the center and extending into prongs or coral-like growths. Eventually the center becomes a mass of these growths, heaped into a cracked and humped crust, which may occupy almost the whole lichen, making it necessary to look sharply for the few scraps of papery lobes around its edge. The under surface is white to pale brown, and somewhat wrinkled, with a few small, brownish holdfasts.

Fruits on the typical form are hardly to be found, at least in the New York area. There are however forms intermediate between this species and *C. placorodia*, having the coral-like growths few and scattered instead of massed in a central crust. These forms are sometimes called var. *diffusa*, and they often bear fruits much like those of *C. placorodia*, with similar spores.

Though variable, *Cetraria aleurites* will be recognized with ease by its white or silver-gray color, and the yellow-gray granular center. Other common Papery Lichens have similar massed granules and coral-like growths, notably *Parmelia rudecta* (Group 6), a lichen with typically much broader parts, rather regularly speckled with small, flat, white soredia. *Parmelia frondifera*, an uncommon form of *P. saxatilis*, has the growths flattened into small lobes, and is distinguished by its black under surface. *Physcia stellaris* and *P. granulifera* (Group 8) often have central granules, but the frequent gray or blackish fruits contain blackish, 2-celled spores.

Cetraria aleurites, *C. placorodia* and *Parmelia ambigua* have



GROUP 5—PLATE 5

Fig. 1. *Cetraria fahlunensis*, dark olive brown.
 Fig. 2. *C. fahlunensis*, tip and older branch.
 Fig. 3. *C. pinastri*, olive-green, yellow beneath.
 Fig. 4. *C. pinastri*, tip with yellow soredia.
 Fig. 5. *C. Oakesiana*, yellowish green, brown beneath.
 Fig. 6. *C. aurescens*, pale yellow-green.
 Fig. 7. *C. aurescens*, tip.

Fig. 8. *C. Fendleri*, olive-brown.
 Fig. 9. *C. Fendleri*, tip.
 Fig. 10. *C. aleurites*, whitish, centrally yellow-gray.
 Fig. 11. *C. aleurites*, tip.
 Fig. 12. *C. placarodia*, pale gray.
 Fig. 13. *C. placarodia*, section of spore layer.
 Fig. 14. *C. placarodia*, spores.

recently been placed together in the genus *Parmeliopsis*, but it seems simpler to follow the older tradition, omitting this new genus.

Cetraria placorodia. PLATE LICHEN.

Also called *Cetraria aleurites* var. *placorodia* or *Parmeliopsis placorodia*. Resembles *C. aleurites* in color and size, but does not develop the central growths and does usually fruit. It is fairly common in the pine barrens, where it may either grow flat on the bark or wood, or may reach out its fan-like tips as much as 1 cm. from the foothold, especially when found on twigs. Branches of nearly uniform width, about 1 mm., radiate side by side, not usually overlapping. The upper surface tends to be more gray or even greenish than the nearly white *C. aleurites*.

Fruits, up to 7 mm. diameter or larger, stand near the center of the lichen, raised 1 mm. or so, the disk round or becoming irregular with age, yellowish gray, later green or brown. The rim may be nearly smooth or broken with radiating ridges or toothed. Spores undivided, colorless 4 to 9 by 3 to 6 microns.

Cetraria placorodia resembles somewhat the larger *Parmelia tiliacea*, which is rather common in swamps, but has a black under surface and constantly chestnut-brown fruits. The yellow-gray fruits of *C. placorodia* distinguish it from most other Shield Lichens except *Parmelia ambigua*, the upper surface of which is distinctly yellowish, the under-surface black. *Lecanora muralis* (Group 13) has fruits of this color, but grows only on rocks. Confusion is likely with *Phycia stellaris* and *P. tribacia* (Group 8), both of comparable size and growing in similar places, but with fruits black or gray dusted with white, and lacking any trace of yellow tint; spores 2-celled and blackish.

Parmelia ambigua. SULPHUR-DUST LICHEN.

Also called *Parmeliopsis ambigua*. Like *Cetraria placorodia* this little lichen frequents the pine barrens, but only in the form of its variety *Halei*, the species itself being found in the mountains to the north, outside the New York area. The variety spreads in oval rosettes 3 or 4 cm. across, usually on pine or white cedar bark, either clinging flat or rising somewhat from the foothold. Sometimes it wanders irregularly among other lichens in fans up to 1 cm. wide, divided gracefully into regularly

forking branches less than 1 mm. wide. The upper surface is straw-color or yellowish green, and sulphur-colored dust (soredia) often edges the branches or forms large rounded masses on the older parts. The under surface is dark brown to black.

Fruits not frequent, up to 5 mm. in diameter, sometimes much larger, plate-shaped or wavy, yellowish gray and waxy looking, the rim thin and irregular, dusted with yellow soredia. Spores 8 to 13 by 2 to 4 microns, but scarce.

Since there are few small lichens with yellow soredia, *Parmelia ambigua* is easily identified. Its form closely resembles *Cetraria placorodia*, but the yellow tint marks it at a glance, and distinguishes it from all species of *Physcia*. The black under surface separates it from *Cetraria pinastri* and *Parmelia centrifuga*, while the masses of yellow soredia mark it from all similar lichens except *Cetraria pinastri*, which is yellow beneath, and *Parmelia incurva*, white beneath and found on rocks only. The yellow and orange lichens in Group 9 are distinguished by having orange or bright yellow fruits.

Parmelia centrifuga. RING LICHEN.

An alpine species of the north seen occasionally on quartz and sandstone as far south as the summits of the Shawangunks. Its trunks and branches, usually about 1 mm. wide, and varying but little except to widen somewhat at the tip, radiate from a center which with age becomes crust-like, and often falls away, leaving the lichen an irregular ring rather than a rosette as much as 10 cm. across. The branches, except at the flattened tips, are convexly rounded and covered with minute, warty wrinkles. The tips are straw-colored or yellowish gray, but the older parts usually darken as though dusted with soot. New growths often cover the old in shingle fashion, and in doing so, may swerve sharply to one side from the otherwise uniform lines of radiation, making a peculiar and characteristic pattern. The under surface is whitish with a few dark, root-like hold-fasts.

Fruits, as much as 8 mm. in diameter, but usually smaller, are chestnut-brown, closely seated on the older parts, and with a thin, pale rim. They are not likely to be seen in the New York area. Spores undivided, colorless, 7 to 12 by 5 to 6 microns.

In size and color, *Parmelia centrifuga* resembles *P. ambigua*,

but differs in the whitish under surface, and in being found on rocks, not tree-bark. The yellow soredia also are wanting, but will be found on the similar *P. incurva*. *P. conspersa*, commonest of Shield Lichens, though extremely variable, is broader in its parts, and the under surface, dark brown to black, will always distinguish it. The ring-like habit is not confined to *P. centrifuga*, nor constant in it, but is strongly suggestive when present.

Parmelia incurva. FIST LICHEN.

Found in association with *P. centrifuga*, and so like it in general appearance as to require no separate description. The chief character determining it is the presence of globular masses of yellowish soredia as much as 2 mm. or more in diameter, and rather like those of *P. ambigua*. The ring-like habit is not usually noticeable. Close inspection will also show that the branches tend to twist about irregularly rather than radiate from a central point, while the tips usually curl, some taking the form of a clenched fist. It will hardly be mistaken for any lichen except *P. centrifuga* or *P. conspersa*. (See comparisons under *P. centrifuga*.)

Parmelia physodes. PUFFED SHIELD LICHEN.

A frequent species on trees and occasionally rocks in the highlands and the pine barrens, becoming very plentiful in the Catskills. It either forms rosettes a few cm. across, or grows irregularly, often intermingled with other lichens. It may rest almost flat against the foothold, or with tips lifted, or, especially when on twigs, may stand out 1 or 2 cm., like the species of Group 4. The habit of branching is highly irregular, trunks and branches usually 1 mm. or less in width, but the tips often much broadened, thickened and puffed. The upper surface is smooth, greenish gray, the under surface black, but shining pale brown and wrinkled under the tips, which usually curl back to show the color conspicuously. Other tips may break open in a form suggesting vaguely a flower of the pea family, the inner surface of which is covered with pale blue dust (soredia), later turning white.

Fruits are very rare, unless *P. vittata* is included in *P. physodes*, as it sometimes is. But the lichen is easily determined without them.

Though variable, *Parmelia physodes* has well marked distinguishing characters. The puffing of the tips, and to a certain extent, of other parts, separates it from all other species of *Parmelia* except *P. vittata*, *P. colpodes* and *P. pertusa*. Typical *P. vittata* forks into long branches of uniform width, with tips which do not broaden. *P. colpodes* has broad tips black and roughened beneath instead of brown and shining. Near the tips of *P. pertusa* are conspicuous small holes puncturing the lichen. The Physcias, which often show swollen parts, usually form more symmetrical rosettes of smaller size. *P. stellaris* and *P. hispida*, the ones most likely to cause confusion, are white beneath and fruit abundantly. The brown tips curled upward distinguish *Parmelia physodes* from all other similar lichens except *P. vittata*, while those tips which have pale blue soredia mark it from all but *Physcia speciosa*, which is not puffed, and is white beneath, with conspicuous white holdfasts.

Parmelia vittata. FORKED SHIELD LICHEN.

Also called *P. physodes* var. *vittata*. Similar to *P. physodes* in most characters, but differing in some which are plainly evident. The trunks and lobes are long and rather straight, of uniform width, about 1 mm., while the tips, though puffed are not broadened, and never sorediate. Branches fork at a wide angle. The black under surface is deeply wrinkled. *P. vittata* may be looked for on trees in the higher mountains, but is nowhere plentiful.

Fruits frequently large, occasionally 25 mm. in diameter, brownish or greenish, wavy, with thin rim somewhat notched or broken. They are lifted as much as 5 mm. high, like mushrooms, and the under surface of the fruit, like that of the lichen, is often black, wrinkled and pitted. Spores undivided, colorless, 4 to 6 by 4 to 5 microns.

Though forms intermediate between *P. physodes* and *P. vittata* do occur, the typical lichens differ so evidently that they may usefully be considered separate species. Since the tips of *P. vittata* do not break into blue soredia, other characters should be noted, especially the long, straight branches with parallel edges, and the habit of forking wide like the letter Y. No other local lichen with puffed tips has this habit. (For comparisons see *P. physodes*.)

Parmelia pertusa. PUNCTURED LICHEN.

This rather rare species will be seen at times wherever *P. physodes* is plentiful, either on mountains or in the pine barrens, and can be recognized after a glance through the lens, for though similar to that species in size and habit, it shows here and there, usually in the middle of a branch or tip, a round or oval hole less than 0.5 mm. in diameter. An observant person will at once notice that these holes appear to be made by insects, but as the punctured parts grow older, the edges of the holes lose the appearance of having been gnawed, and look as if formed in the growth of the lichen. Examination of the under surface will show that patches of the black, spongy material have been eaten off or tunnelled through, exposing the white pith.

While insects are probably responsible for this determining character, there are other points on which *P. pertusa* differs from *P. physodes*. The soredia, instead of being borne on flower-like tips, usually start as whitened lumps well back from the tip and develop commonly into mushroom shape, with *white* soredia on the top.

Fruits are unknown in this region, but when found in the tropics, the spores measure 45 to 60 by 22 to 28 microns, about 7 times longer than those of *P. physodes*. It is best therefore to consider *P. pertusa* a distinct species. It will not be confused with any other lichen, because no other is regularly punctured in this fashion. (For detailed description and comparisons, see *P. physodes*.)

Parmelia colpodes. BLACK-PAW LICHEN.

Also called *Anzia colpodes*. Found on tree bark rather frequently in the pine barrens, occasionally on mountains. Though at first sight this fourth of the Shield Lichens with puffed tips, looks like a darkened *P. physodes*, closer inspection will show it to be entirely different—so different that some put it in a special genus *Anzia*. It forms straggling rosettes 3 or 4 cm. across on tree-bark, preferring oaks. The narrow main trunks divide into broader branches and still broader tips, but few parts are broader than 2 or 3 mm., while many are 1 mm. in thickness. The olive-green or blackish main trunks (turning white in old herbarium specimens) are often arched, and roughened with warts

and wrinkles. Tips take a paw-like shape with upper surface moderately dark green, bordered with a whitish line where it meets the under surface. This under surface is black, roughened by tiny papillae standing close together, and visible as a nap under a strong glass, but with weaker magnification, showing only as a dull finish, in contrast to the shining under-tips of *P. physodes*.

Fruits are usually rather abundant, scattered along the older trunks and branches, bowl-shaped, chestnut-brown or darker, with a thick, smooth, pale rim. They are of all sizes up to 8 mm. diameter, and when large are often of irregular shape. The spores, undivided, colorless, very small, 3 to 6 by 1 to 2 microns, are numerous in the spore sack, instead of numbering only 8, as in most Shield Lichens, and are usually shaped like a curved sausage.

Under the microscope, *P. colpodes* is easily differentiated as the only local Shield Lichen with more than 8 spores in the spore-sack, and the only one with curved spores. With a hand lens alone however, it can be determined definitely, because no other local lichen of this type has the black nap under the tips, which is perhaps 0.1 mm. deep, and not at all like the much longer blackish holdfasts of such lichens as *Physcia endochrysea*. The presence of fruits and the absence of sorediate tips distinguish it at once from *P. physodes* and *P. pertusa*. From *Physcia stellaris* and *Cetraria placorodia*, its darker color and black under surface easily separate it.

Parmelia olivacea. OLIVE-BROWN SHIELD LICHEN.

Rather frequent everywhere on trees where other Shield Lichens grow, *P. olivacea* often escapes notice because its color does not differ greatly from that of the bark. It spreads irregularly, flattening against the foothold, and the tips of the lobes often widen to 5 mm. or even more, but very thin, in contrast to the puffed lichens just described. About 1 cm. or so behind the tips, it often becomes a thin shapeless crust with confused wrinkles instead of radiating branches. Near the tips, the color is yellowish-brown to chestnut, or olive when wet, often shining like bronze metal, while older parts may blacken, or show dots of whitish soredia, or white where the brown surface has been scratched off. The under surface is dark brown or black.

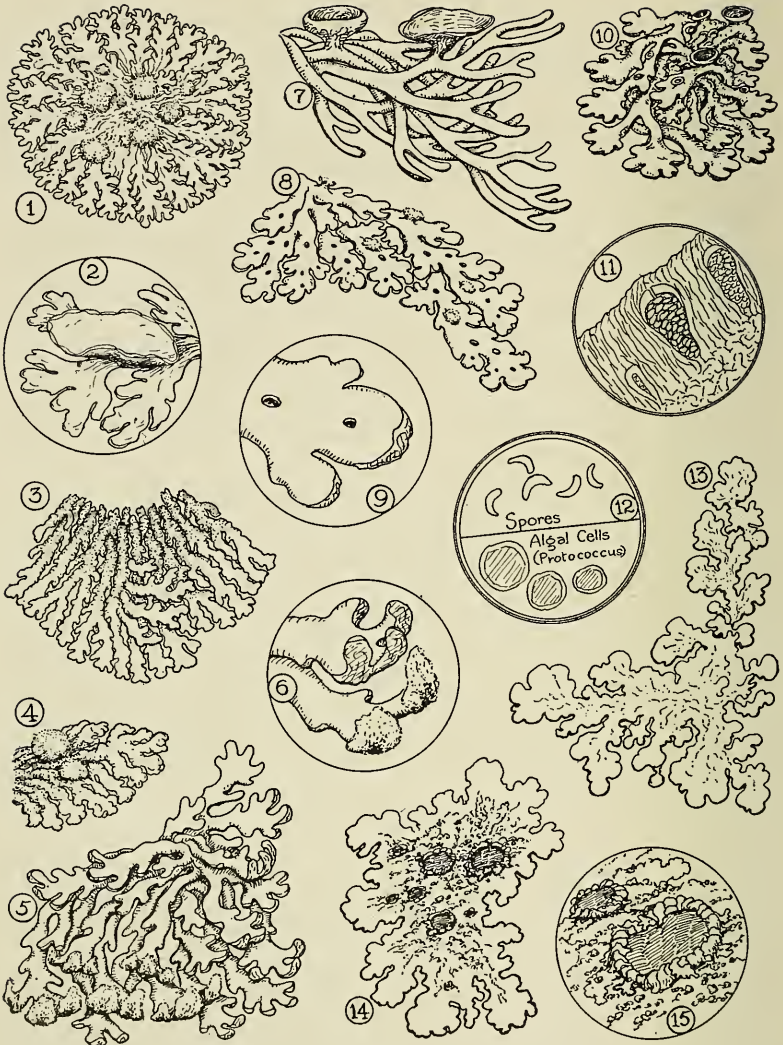


PLATE 6

- Fig. 1. *Parmelia ambigua*, straw-color.
 Fig. 2. *P. ambigua*, tip with fruit.
 Fig. 3. *P. centrifuga*, pale yellowish.
 Fig. 4. *P. incurva*, pale yellowish.
 Fig. 5. *P. physodes*, greenish gray.
 Fig. 6. *P. physodes*, tips with brown under surface and pale blue soredia.
 Fig. 7. *P. vittata*, greenish gray.

- Fig. 8. *P. pertusa*, greenish gray.
 Fig. 9. *P. pertusa*, tip showing punctures.
 Fig. 10. *P. colpodetes*, dark greenish.
 Fig. 11. *P. colpodetes*, section of spore layer.
 Fig. 12. *P. colpodetes*, spores.
 Fig. 13. *P. olivacea*, bronze-brown.
 Fig. 14. *P. aspidota*, bronze-brown.
 Fig. 15. *P. aspidota*, fruits.

Fruits when present are usually small, but occasionally reach 7 mm. diameter, chestnut-brown or blackish, with a wavy or warty rim. They will seldom be seen except on high mountains. Spores undivided, colorless, 7 to 16 by 5 to 10 microns.

The rich brown shades differentiate *P. olivacea* from most other Shield Lichens that grow on tree-bark, while the smooth, flat margins contrast with the toothed and raised edges of *Cetraria Fendleri*. From the papery species of *Collema* (Group 11), which often grow on trees, its shining and hard-looking surface separates it easily, for their surfaces are dull when dry, gelatinous when wet. The gelatinous lichens are found usually near the base of the tree, while *Parmelia olivacea* more often occurs 1 to 3 meters high on the trunk. *Dermatocarpon arboreum* (Group 12) is thick, dull, and when wet, bright green. *Physcia aquila*, though brownish, has conspicuously long, narrow branches and tips, overlapping shingle-fashion.

Several varieties and subspecies of doubtful value have been separated from *Parmelia olivacea*, and may be noted if desired. *P. aspidota*, the most common and best justified, has the surface much roughened with small warts and larger blisters, while the fruit-rims are often fantastically contorted and lobed. *P. conspurcata*, somewhat larger, with much broader lobes, has many white soredia, and whitish coral-like growths. *P. prolixa*, found on rocks instead of trees, has narrower parts, approaching the northern *P. stygia*.

(Group 6 will contain all of the larger Parmelias.)

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